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Jean Dijon

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EXAMINER

PADGETT, MARIANNE L

ART UNIT

PAPER NUMBER

1715

NOTIFICATION DATE

DELIVERY MODE

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ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/588,703	Applicant(s) DIJON ET AL.	
	Examiner MARIANNE L. PADGETT	Art Unit 1715	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 March 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10, 12-18 and 20-25 is/are pending in the application.
- 4a) Of the above claim(s) 3, 10, 12, 18 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 2, 4-9, 13-17 and 21-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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1. The examiner wishes to remind applicants that when submitting amendments with deletions of five characters or less, especially **single character deletions** or other deletions within this range that are difficult to see; they should be made with double brackets, [[]], (see claim 8, line 4; claim 12, line 6; claim 13, line 3; claim 16, line 4; & claim 20, line 7), particularly punctuation, which instead of necessarily showing a deletion, frequently merely makes a new character, i.e. a strike between the dots of a ":" becomes division sign (claim 10, line 2; & claim 18, line 2). To avoid noncompliant amendments in the future, please use [[:]], and like, as appropriate.

2. The examiner notes that applicants have sort of combined the limitations of **Species Grouping B (i) & (ii)** {(i) carbon nanotube or carbon nanofiber formation; & (ii) oxide layer formation} uses of fragmented layer or layer of droplet shaped bodies (as amended), which as disclosed in the original application are two different uses (page 12) of the initially formed "fragmented layer" ≡ layer of droplet shaped bodies. As amended withdrawn claims 12 & 20, recite preparing "a catalyst structure", where the independent claims says that it is catalyst material for forming carbon nanotubes (CNT) or carbon nanofibers. However, just because the layer material that is shaped into droplets can be used to catalyze carbon nanotubes or carbon nanofibers, does not mean that it is, hence when it is coated with an oxide film, it is no longer a catalytic structure, but modified structure with an oxide surface layer (different enduse than CNT formation), and remains nonelected. It is further noted that **dependent claims 10 & 18** have been amended to also forming an oxide film, so that they are now directed to nonelected Species Grouping B(ii), hence have been **withdrawn** from consideration.

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3. **Claims 1-2, 4-9, 13-17 & 21-25** are rejected under 35 U.S.C. **112, second** paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Independent **claims 1 & 13** have been amended, plus new independent **claim 21** has been presented requiring a "process for preparing a catalyst structure", however the body of the claims are not commenced in scope with these preambles, because while a material called "a catalytic material" is employed and it has the capability of being suitable for catalyzing CNT or carbon nanofiber formation, the process has no actual claim of any "catalyst structure" been *necessarily* formed (i.e. the "droplet-shaped bodies of the catalytic material adhered to the substrate have not been necessarily defined as being the "catalyst structure" of the preambles. This problem is especially significant in dependent claims that require one to be employing this limitation only present in the preambles, in further processing, such as **claims 8-9 & 16-17** (& nonelected claims 10, 12, 18 & 20).

In **claims 1 & 13**, the limitations "the substrate comprises a material having a surface tension lower than a surface tension of the catalytic material", or "the barrier layer comprises a material having a surface tension...", however the examiner notes that these surface tension relationships are claimed with respect to the materials (i.e. something the substrate or the barrier layer "comprises" versus catalytic material), but it is surfaces to which "surface tension" is applicable, as a particular material may form layers with different surface tensions due to different morphologies, etc., thus these surface tension relationships do not provide clear meaning, as *presently written*. Note that the disclosure in the original specification bridging pages 3-4 states that "It is also preferable for the **surface tension of the material on the surface**

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of the support to be lower than the **surface tension of the material to be divided**" (emphasis added), where the context of the "material to be divided" from page 3, lines 13-30, is that it is the thin layer of material deposited on the surface of the support, thus while the examiner might assume that applicants intent was to claim this teaching, they have not actually done so, but instead claimed an unquantifiable & unclear relationship, since the claim limitations do not specify under what conditions & when the two relevant materials have the surface tension relationship, with the complications created by "comprises" language which means that anything else may be present which may totally change any surface tensions between two actual layers of mixed compositions of materials.

Claims 4-5, 13, 22 & 25 have limitations directed to "a barrier layer", but failed to have any limitations which describe to what the layer is a barrier. It is noted that further limitations of the barrier layer being TiN to a layer now amended to "comprises TiN", thus may contain any other material also, it means that this barrier for unclaimed purposes, cannot be considered defined simply by the materials used as we no longer know its actual composition. While in the previous claims we did not know what was being prevented from defusing, now the uncertainty is even broader. Therefore, as written, since any material could be considered to be a barrier to something, whether it's a physical property (heat, electricity), a physical substance (diffusion of particular elements), an action of another entity (vision), etc., this "barrier layer" is now virtually unlimited with respect to its composition & effect, except in dependent claims 5, 22 & 25, where some, but not *necessarily* all compositional components are identified. However, note that in **claim 22**, since there is no barrier layer employed in the process of independent claim 1, "the

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barrier layer" of dependent claim 22, lacks any antecedence & it's use in the claimed process is even more unclear.

While the capability of the catalytic material in independent claims 1, 13 & 21 has been clearly stated to be "for catalyzing formation of **carbon** nanotubes or **carbon** nanofibers" (emphasis added), and some improvements in clarity have been made in dependent claims, there remains uncertainty in **claim 8**, lines 1-2 & 5; **claim 9**, lines 2-3; **claim 16**, lines 1-2 & 5; and **claim 17**, lines 2-3, which recite "**carbon** nanotubes or nanofibers", such that it is ambiguous whether or not the nanofibers are carbon or may be made of any material.

In **claim 21**, line 6, recites "the substrate **comprises** a material that **does not react** with the catalytic material" (emphasis added), which either is very broad & very narrow at the same time, or ambiguously unclear. As presently claimed, there is no limit under what conditions "a material" is prohibited from reacting with the catalytic material, which could be considered that it may not react under any conditions, which considerably narrows what "a material" could be, while at the same time "comprises" literally means that "a material" could be located in any part of the substrate, mixed with any other materials, such that it may never even be in contact with the catalytic material, which considerably broadens its scope. One could also interpret the "not react" limitation that if there is some condition where no reaction occurs that it is a claimed material, whether or not those conditions are relevant to any stage of the claimed process, etc. Alternatively, the examiner suspects that applicants were attempting to claim the concept as disclosed on page 4, line 4-14 of the original specification, such that applicants may have intended that the substrate surface on which "a layer of catalytic material" is claimed to be forming, to not interact with the catalytic material, when it's being deposited as a layer & formed

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into droplets; *but this is not what is claimed*. Thus, given these hints of possible intent, plus possible different interpretations, the claim language may be considered ambiguous as to the meaning intended, i.e. it is unclear under what conditions what part of the material that the substrate comprises should be required to not react with the catalytic material.

4. **Claims 1-2, 4-9, 13-17 & 21-25** are rejected under 35 U.S.C. **112, first** paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In independent **claims 1 & 13**, the claim of some material in the substrate having a surface tension lower than a surface tension of "the catalytic material" in some unspecified condition (i.e. shape, morphology, location, etc.) at some unspecified time, was not found to be supported by the original specification, which as pointed out above in section 3, provides a teaching in the paragraph bridging pages 3-4, which corresponds to very specific configurational conditions where the materials have the claimed surface tension relationships, and where there is no "comprises" involved in the material compositions. Hence, this new limitation is broader than the original disclosure, thus must be considered to encompass **New Matter**.

Similarly, in independent **claim 21**, the claim of some material in the substrate not reacting with the catalytic material under unspecified conditions at an unspecified time, was not found to be supported in the original specification, which as pointed out above in section 3, provides teachings on page 4 with respect to where the relevant materials are located & context

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as to when interaction should not take place. Hence, this new limitation is broader than the original disclosure, must be considered to encompass **New Matter**.

Independent **claims 1, 13 & 21**, all have the limitation requiring "forming a layer of the catalytic material **comprises** forming **multiple separate layers** of catalytic material over a period of time" (emphasis added). In the support cited by applicants, page 3, lines 23-27 discloses that "Deposition in discontinuous form means a sequence of deposits of the **same material** separated by waiting phases **under a vacuum or** in a **controlled atmosphere**, in other words the deposition is discontinuous in time" (emphasis added). While this sequence of actions can produce a layer formed of multiple separate layers (superimposed or spaced across a substrate), thus is encompassed by the new claim limitation; so can using a brush with liquid on it & painting a substrate multiple times or in multiple places, thus applicants' claimed multiple separate layers are considerably broader than this disclosure of the specification. Also note that forming multiple separate layers over a period of time, includes the meaning that while the multiple separate layers can not all form instantly, they can all be formed over the same period of time, which possibility is also not supported by the page 3 disclosure. Further review of the specification finds that figure 1, described on page 6-7, is providing a specific means of performing the "discontinuous deposition", which provides clarity with respect to the definition of page 3, by showing a means by which the discontinuous deposition may be performed using only one material, which provides context for what is meant by "waiting phases under a vacuum or in a controlled atmosphere"; and which is also considerably narrower than depositing multiple separate layers of any number of compositions under any conditions via any means, over any periods of time, as well as any possible meanings of "multiple separate layers", an especially

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considering "comprises" makes the claimed limitation even broader in unspecified ways, which no disclosure of the specification was found to support or define. Thus, while this new limitation with respect to multiple separate catalytic material layers formed is inclusive of taught layer formation for forming droplets of material on a substrate, this limitation is also considerably broader than the original disclosure, so must also be considered to encompass **New Matter**.

Applicants have broadened the scope of numerous limitations by adding "**comprises**" to various claim limitations, i.e. "substrate comprises a material..." (**claim 1**, line 8; **claim 21**, line 6); "separating the layer... into droplets-shaped bodies comprises applying a heat treatment" (**claims 2 or 14**); "substrate comprises a barrier layer..." (**claim 4**); "catalytic material comprises nickel" (**claim 5**) or "catalytic material comprises a metal or a semiconductor" (**claims 6, 23 or 24**); "forming the layer of catalytic material comprises forming a layer under partial pressure of oxygen" (**claims 7 & 15**); "barrier layer comprises TiN..." (**claims 5, 22 or 25**) or "the barrier layer comprises a material having surface tension..." (**claim 13**); and "growing carbon nanotubes... comprises growing carbon nanotubes... by chemical vapor phase deposition" (**claims 9 & 17**). While original claim language used "comprises" in the preamble, thus with respect to limitations representing stages of the process, this does not provide support for broadening the scope of individual limitations by inserting "comprises" in the middle of them, so as to broaden their scope of what might be included in a composition of the substrate, or the barrier layer, or the catalytic material, or the gas conditions employed during layer formation, or what else might be applied with heat to cause droplet formation, or what might be combined with vapor phase deposition techniques.

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More specifically, with respect to the broadened scope of "**barrier layer**", both with respect to its claimed compositions & with respect to its function, original claim 4 was directed to "a thermal or diffusion barrier layer"; while original claim 5 further limited it to "being made of TiN", while "the material being nickel" was deposited on it (or claim 6 indicated that material was metal). Page 4, lines 8-14 of the original specification teach "If the support interacts excessively with the material to be divided during the deposition and then the plasma treatment steps, a diffusion barrier layer can be made in advance, for example a TiN layer if the first material is nickel...". Page 6, lines 8-12 is depositing nickel, with the paragraph bridging pages 6-7 indicating a possible use of a diffusion barrier layer 12, as illustrated in figure 2. Ex. 1 on pages 7-8 is directed to a 60 nm thick layer of TiN on which a layer of Ni (2 nm or 3 nm or 5 nm or 10 nm), which then heat-treated. Ex. 2 pages 9-10 uses the same depositions (i.e. materials) of Ex. 1, while Ex. 3 (page 10) also deposits Ni on TiN layer, but the Ni deposit is made with a specific partial pressure of O₂ to deposit nickel layers of 3 & 10 nm thicknesses. None of these disclosures indicate that TiN barrier material may "comprise" other components.

More specifically, with respect to the broadened scope of "catalytic material", original claim 8 was directed to "catalytic metal layer"; while page 4, lines 15-20 indicate that "a catalytic metal such as nickel, iron or cobalt", with page 4, lines 25-29 indicating that this catalyst layer is for production of CNT & [carbon] nanofibers. Page 11 indicates that the catalyst made according to the invention, which in context would be those of preceding examples 1-3, were satisfactorily used for growing nanotubes via thermal CVD with acetylene. None of these disclosures indicate that the catalytic material used for making CNT or carbon nanofibers maybe anything but a metal or the recited metals Fe, Ni or Co, nor does the original disclosure indicate

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that metals may be mixed with other unspecified materials as now indicated in the claims by using "comprises".

Page 5, lines 1-2, indicate that nanotubes & nanofibers may be grown by chemical vapor deposition, but do not indicate combination with any other deposition techniques, i.e. no "comprises", nor did the disclosure noted above on page 11 with respect to thermal CVD nanotube growth with catalysts provide support for "comprises", thus amended claim limitations are encompassing **New Matter** by suggesting combination with other unspecified growth techniques.

Page 4, lines 21-24 indicate that deposition of "a layer of catalytic metal can be done in the presence of a partial pressure of oxygen, which gives better control over the diameter of the catalysts grains", which did not give support for "comprises", nor did the above-mentioned Ex. 3, which used a specific partial pressure of O₂ to deposit nickel layers, thus lacking support for broadening possible gas mixtures or techniques combined with oxygen partial pressure, included by "comprises", hence amended phrasing would appear to encompass **New Matter**, as well as clearly supported actions.

Page 12, lines 3-18, has a more general discussion related to "a process capable of obtaining particles of a given material on one face of a support", where the material from which the particles are being formed may be "metallic (iron, nickel, cobalt, or semiconductors compounds, for example silicon)", but these materials are **not** said to be or taught to be used as catalysts for carbon nanotube or carbon nanofiber production, but only for obtaining particles on a support. That the listed materials overlap with materials taught earlier as catalysts for CNT formation, does not provide support for semiconductor compounds that can be formed into

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particles to be used as catalysts for CNT formation. Therefore, applicants' inclusion of the class of all semiconductors as being capable of catalyzing CNT or carbon nanofiber formation, does not appear to be supported by the original specification, thus constitutes **New Matter**. The use of "comprises" language was not found in association with teachings of catalytic material, thus amending the claims to include the "catalytic material comprises a metal" encompasses unsupported compositions by including other than the specifically taught metal, thus encompassing **New Matter**, along with the supported metals.

Page 12, lines 12-18, discloses the "support face is chosen to interact only slightly with the material to be divided (little diffusion, little or no chemical reaction). This is the case for nickel on TiN, but also more generally of metals on an oxide or silicon on an oxide. A diffusion barrier may be inserted if necessary (for example made of TiN or oxide, etc.)". This is generic disclosure directed to obtaining particles in general as discussed immediately above, not specifically to catalytic material for CNT formation, however as metals are taught generically as CNT catalytic material & metals are generically mentioned as possibly using generic oxide barriers against diffusion during the taught processing of the material being divided, the claim of oxides as barrier materials would be supported, if the purpose of the "barrier layer" was clearly set forth in the claims (it is not) & if the barrier layer composition containing "oxides" did not have the possibility of containing anything else also due to the use of "comprises", thus as *presently written*, the claimed materials for the barrier layers also encompass **New Matter**.

5. **Claims 1-2, 4-9 13-17 & 21-25** are rejected under 35 U.S.C. 112, **first** paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter

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which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention

While applicant's amendments have corrected many enablement problems, as discussed in section 5 of the action mailed 10/21/2009; they have created new problems, in that the examiner **finds no evidence** in the original specification that all possible depositions by all possible techniques of multiple separate layers of actually disclosed a catalytic material for CNT & carbon nanotube production, or inclusive of all semiconductors as presently claimed, either inclusive of all possible thicknesses of depositions of multiple layers, mixed or not with unspecified other materials (comprises), would have been expected to behave as set forth in examples 1-3 & separate the deposited layer of multiple separate layers into droplet shaped bodies by either disclose techniques of heat treatment or low temperature hydrogen plasma *{nonelected, relative term defined page 7 as ambient (about 20°C)-500°C, but ambiguously as an example by using "typically" to preface the definition}*; nor any generic teaching that such a droplet structure could be effectively created from the currently claimed scope of the layer of catalytic material. While page 3, lines 13-page 4, line 24 indicate that parameters other than the thicknesses are being employed to control the division of the deposited material, they do not indicate that the thicknesses is unimportant, i.e. that any thicknesses may be employed, nor does applicants' disclosure indicate that the deposition techniques is unimportant, in fact the discussion on pages 6-10 would appear to consider that applicants' specific discontinuous deposition of layer techniques, which is using a vapor deposition technique with very specific requirements, is critical to their demonstration of providing control of particle formation diameter, i.e. droplets formed from the layer deposited on substrate. Hence, there would appear

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to still be enablement problems with respect to the claim limitations, as presently written, & what actions the teachings of the specification enable to both form the droplets & do it with superior control than prior art techniques (e.g. standard Ni layers referred to in examples). It is noted that while the above discussed problems with respect to descriptions of the substrate &/or barrier layer contribute to this problem, but even if they were corrected to accurately present the limitations as disclosed on pages 3-4, they would not be sufficient to overcome the enablement problems caused by the scope of "forming the layer of the catalytic material comprises forming multiple separate layers of catalytic material over a period of time".

6. It is noted that applicants' amendments have significantly clarified their intended meaning for their process, so as to **overcome** some previously applied art rejections, inclusive of the process for making candles as set forth in section 7 of the action mailed 10/21/2009, as well as **Dominguez et al.** (2007/0196575 A1) of section 17, as the present application is required to be a true translation of the PCT parent for the 371 filing, hence applicants are correct in asserting that Dominguez is not prior art.

Is noted that in the new claim language of "separating... into droplet-shaped bodies... adhered to the substrates", the "droplet-shaped bodies" are considered to read on material "beaded" on a surface or coalesced on the surface into space apart concentrations of material, as in seeds or grains of material.

7. The following is a quotation of the appropriate paragraphs of **35 U.S.C. 102** that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of **35 U.S.C. 103(a)** which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names **joint inventors**. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The **nonstatutory double patenting rejection** is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

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A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

8. **Claim 1-2, 4, 6 -7, 13-15 & 21-25** are rejected under 35 U.S.C. **102(b)** as being anticipated by **Raaijmakers et al.** (2003/0234417 A1).

Claims 10 & 18 have been removed from this rejection, as they are no longer elected claims as discussed above, while claims 4 and 6 have been added due to their broadened scope, which is similar to those of new dependent claims 22-25. Specifically, while all present independent claims require deposition of a "catalytic material" that is suitable for catalyzing CNT production, this "catalytic material" as further limited in the dependent claims encompasses any material that happens to contain **any metal or any semiconductor** materials, hence **Raaijmakers et al.**'s teachings of depositing high dielectric material layers, such as a zirconium dioxide, which comprise the metal Zr, are encompassed by applicants' new claim language. With respect to the requirement of forming multiple separate layers over a period of time, the taught ALD deposition ([0033-35]; [0043-44] & Ex. 1, esp. [0062-65 & 68]) clearly read on this technique, considering as defined, atomic layer deposition is a series of pulsed depositions, with each pulse or set of pulses providing a sublayer deposition, thus multiple separate layers deposited at different times over a period of time. Particularly note [0033] teaches that ALD involves alternating surface reactions of vapor phase reactions or precursors employing pulses of reactive vapor that are absorbed on the substrate, with Ex. 1 teaching a specific metal phase

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deposition using $ZrCl_4$, followed by a oxygen phase, which cycle is repeated to deposit a desired thickness of zirconium dioxide. Note that this process satisfies applicants' multiple layers over a period of time, where forming the layer comprises doing so under a partial pressure of oxygen & satisfies what the catalytic material may be considering the new "comprises" language. With respect to whether or not to deposited materials react with the underlying substrate surface, as set forth in [0054], an oxide interlayer is used for the equivalent function as barrier layers described in applicants' specification, as well as equivalent material as now claimed, so can be considered to prevent reaction; although as presently claimed, as there are materials in Raaijmakers et al.'s substrate that do not come into contact with the material of interest being deposited, hence they do not & cannot react therewith, so may be considered to read on applicants' limitation *as phrased*. With respect to the alternative independent claim limitations with respect to surface tensions, as it is presently phrased in a manner that has no clear meaning, as materials themselves without regard to any surfaces created by them, do not have any innate surface tensions, so as written, there is no way to actually treat this limitation meaningfully.

As previously set forth, **Raaijmakers et al.** (abstract; figures, esp. 2-5; [0031-36, esp. 32-33]; [0043-44]; [0048]; [0053-54]; [0062-63]; & [0071]) teach formation of a discontinuous layer on a conductive support, or a conductive support having an oxide interlayer (\equiv thermo or diffusion barrier layer), where layer deposition may be via atomic layer deposition (ALD), with the initially deposited layer being a continuous layer, which is thereafter annealed in order to cause a restructuring of the thin layer, including so as to form crystallize grains with gaps there between ([0044]). This grain microstructure may be considered 'drop' shaped, so to read on applicants' "separating the layer...into droplet-shaped bodies...adhered to the substrate", as well

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as producing a "controlled roughness", noting that while the formation of the grain structure with gaps does not read on the literal meaning of "droplets", it is consistent with meanings for "droplet-shaped bodies", therefore may be considered to be encompassed by applicants' claim language. Note with respect to the ALD deposition process, that it is a discontinuous process in the sense defined on p. 3 of applicants' specification, as it involves deposition cycles with pauses for purging between each deposition phase. Furthermore, as noted in Ex. 1 in [0063], the deposition process includes an oxygen phase that employs water vapor to cause oxidation reactions of the deposited zirconium metal to form zirconia, thus during deposition there is inherently an oxygen partial pressure present during the oxidation reaction portion. With respect to thermal or diffusion barrier layers, it should be noted since no particular thermal or diffusion environment is indicated to be protected against by the claimed generic barrier layer, that the materials to provide the claimed effect are not limited, and virtually any intervening layer between the support & the deposited material may be considered to read on the barrier layer requirement, such as Raaijmakers et al.'s oxide interlayer as illustrated in figure 5.

9. **Claims 1-2, 4, 6, 8-9, 13-14, 16-17, 21 & 23-24** are rejected under 35 U.S.C. **102(b)** as being anticipated by **Ida Lee** (WO 03/027011 A2) or **Merkulov et al.** (2002/0117951 A1).

Note with respect to the new limitation of "forming multiple separate layers of the catalytic material over a period time", while **Ida Lee** (WO)'s illustrate the formation of a single catalyst tip in figures 5 & 6, discussed on page 8, lines 8-17, or on individual tips of cantilevers, with electrolytic deposition of a discreet spot of metal catalysts (33) via taught short electrical pulses delivering a controlled number of atoms; Ida Lee 's disclosure also discusses multiple tips

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(i.e. page 8, lines 31-32), deposition on silicon substrates (page 10, lines 14-19 & figure 7), deposition of arrays of catalysts & single carbon nanostructures on cantilevers substrates (example II, page 13, line 15+), the techniques used for mass production of catalyst dots (page 14, line 4+) with specific exemplary discussion of using the taught process for micrometer & nanometer fabrication of any device requiring controlled placement of carbon nanostructures on contacted tips or on nanometer structures in general. The specific example (figure 10 & page 14, line 30-page 15, line 13) suggests the process use for creating multiple pairs of nano electrodes (#s 73+75) on a silicon substrate (71) using multiple nanodot catalysts (33) using the techniques described for creating single nanodot catalysts (discussed below), thus clearly reading on three separate depositions, spaced in time, forming a layer with patterned deposits at separated desired locations, thus reading on possible meanings of applicants' new claim terminology.

As previously set forth, **Ida Lee** (abstract; figures, esp.5-9; p. 8, lines 10-21 & 28-32; p. 9, line 5-p. 12, line 24, esp. p. 9, lines 8-10 & 18-22 & 29-p. 10, line 4+ p. 11, lines 1-24+ p. 12, lines 9-19) teaches metal (Ni) catalyst induced growth of carbon nanotubes, where the catalyst may be deposited on a buffer layer that *should be relatively nonreactive* (e.g. titanium ≡ diffusion barrier layer) via in electrolytic deposition process that employs short (ns-ms) pulses of precisely controlled electric current in order to deposit 100-2500 atoms per pulse (i.e. a temporally discontinuous deposition process). Furthermore, Ex. I discusses annealing Ni/titanium dots on a silicon substrate at elevated temperatures, where an initially continuous, disc shape nickel catalyst deposits balls up, & separates into multiple smaller dots or retains a single dot structure, dependent on various process parameters (dot size, thickness, buffer material, catalyst material, etc.). Carbon nanotubes structures are formed on the balled up nickel

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dots via a CVD process, such as one employing a mixture of acetylene & ammonia-helium.

Note that the teaching of the annealing (heat treatment) causing balling up is consistent with meanings/context for "separating the layer... into droplet-shaped bodies... adhered to the substrate" now required by applicants' claim language. Note that this process may also be considered to provide controlled shape, therefore controlled roughness.

Alternatively, **Merkulov et al.** (951) discuss creating their deposition of catalyst (Ni) dots via use of a resist mask having openings with diameter D, where electronic evaporation of the catalyst metal deposits a coating on a buffer layer in the resist openings, as well as on the surface of the resist, which coated resist is then lifted off the substrate, thus creating multiple dots or pattern array of dots on the substrate ([0026]), i.e. a patterned layer consisting of multiple separated layers, where the process of producing this is done over a period of time, which reads on possible meanings of applicants' new claim language.

As previously set forth, **Merkulov et al.** ((951): abstract; figures, esp. 1-2; [0023-31], esp. [0026-27 & 31]) teach growth of carbon nanotubes employing a catalytic precursor, such as Ni or other metals such as Fe or Co as catalyst, where catalyst nanoparticle(s) are formed, such as by employing an electron beam lithography process with electron gun evaporated metal on to a buffer layer, exemplified by Ti, which prevents diffusion of catalyst & catalyst silicide formation. The deposited layer may be a discontinuous deposition via use of a resist layer to form a multiple dots or patterned arrays of dots. (Note this discontinuous deposition still reads on the terminology employed in the claims, rather than the more specific definition applied to different language in the specification or the example therein.) Before use as catalyst for forming the carbon nanotubes, the Ni/Ti may be plasma pre-etched in ammonia or hydrogen gas, &

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annealed at elevated temperatures (e.g. 700°C), where the titanium layer continues to adhere to the silicon substrate & where the initially continuous nickel layer thereon breaks into one or more little nanoparticle droplets (e.g. \equiv drops). Thereafter, carbon nanotubes are grown on the nanoparticle catalyst in a vertical direction via use of acetylene & ammonia gas mixtures.

10. **Claims 5, 22 & 25** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Ida Lee** (WO) or **Merkulov et al.** (951), as applied to claims 1-2, 4, 6, 8-9, 13-14, 16-17, 21 & 23-24 above, and further in view of **Lee et al.** (EP 1061041 A1).

While **Ida Lee** (WO) teach buffer layers (e.g. diffusion barrier layer), such as Ti, W, Mo or W-Ti alloys, to prevent interaction (nickel silicide, etc.) between a substrate (Si) & the deposited catalyst (Ni, Co or Fe), or **Merkulov et al.** provides analogous teachings as discussed above, neither **Ida Lee** (WO) nor **Merkulov et al.** particularly specify TiN nor oxides as their intervening/buffer/barrier layer, however **Lee et al.** (EP), who is also employing metal catalyst, such as Ni, Co, or Fe deposited via common thermal deposition, e-beam deposition or sputtering, then post-treated to be in nanoparticle form, as a catalyst for CVD deposition of carbon nanotubes; provides analogous teachings of employing intervening layers to prevent interaction between substrate and catalytic metal, where those intervening layers may be insulating film, such as **silicon oxide** or **alumina**, or metal films said to include **Ti**, **titanium nitride**, Cr or W. Thus Lee et al. (EP) is teaching the equivalence of Ti, & TiN or insulating oxide films, as barrier layers to prevent interaction between substrate & catalytic Ni in analogous processing steps, hence it would've been obvious to one of ordinary skill in the art to employ titanium nitride or silicone or alumina as alternative buffer layer materials to the taught metals of either primary

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reference, such as titanium, with a reasonable expectation of equivalent effectiveness due to their shown equivalence for like purposes.

11. **Teo et al.** ("Field emission from dense, sparse & pattern arrays of carbon nanofibers"): abstract; & 4th-5th paragraphs) provide equivalent teachings to those provided in **Lee et al.** (EP) in teachings options for diffusion barrier layers, including SiO₂ or TiN used with Ni catalyst for growth on Si substrates, performing CVD carbon nanofiber structures.

12. **Claims 7 & 15** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Ida Lee** (WO) or **Merkulov et al.** (951), as applied to claims 1-2, 4, 6, 8-9, 13-14, 16-17, 21 & 23-24 above, and further in view of **Choi et al.** (6,538,367 B1).

Neither **Ida Lee** (WO) nor **Merkulov et al.** (951) provide teachings that would indicate the presence of any oxygen in during the deposition of their catalytic material. However, **Choi et al.** is also directed to techniques for depositing catalytic material that is to be employed for catalyzing carbon nanotube or nanoconductor formation, providing multiple alternatives for means of providing catalytic material (col. 5, lines 63-col. 7, line 41), mentioning that fine nanoparticles of iron, cobalt, nickel or their oxide particles are effective as catalyst for nanoconductor nucleation in growth; that deposition of metal catalyst (e.g. Fe, Co, Ni) thin films may be via CVD, electrochemical deposition or physical vapor deposition (PVD) techniques, with subsequent heating to cause particulate formation; that employing porous substrate material & short duration vacuum deposition techniques or electrochemical means to selectively fill catalyst particles into the porous substrate's surface; etc., are effective means for supplying catalyst; hence it would've been obvious to one of ordinary skill in the art that for Ida Lee's electrochemical deposition techniques or for Merkulov et al.'s electron evaporation technique

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(i.e. a PVD technique), that the presence of some partial pressure of oxygen would reasonably have been expected to provide no harmful effects, & would still have been expected to provide catalytic material even if oxide materials were formed, as the oxides of the taught metal particles of the primary reference's would also have been expected to have catalytic properties for carbon nanotube construction. It is *further noted* that since a presence of a partial pressure of oxygen, includes **any partial pressure of oxygen**, no matter how minuscule, and as the claimed limitation with respect to oxygen partial pressure does not require any results from the presence of a partial pressure of oxygen, this claimed limitation may also be considered to include very low partial pressures that may result from evacuation of the atmosphere which are typically used in PVD techniques as taught by Choi et al. or Merkulov et al., which deposit metal & do not result in metal oxide deposits, thus further providing a reasonable expectation of the presence of at least some partial pressure of oxygen as claimed in any PVD process for catalytic metal deposition, since the vacuum is produced are not absolute vacuums, thus would have residual gas molecules inclusive of oxygen molecules.

13. **Claims 1-2, 4-9, 13-17 & 21-25** are provisionally rejected on the ground of **nonstatutory obviousness-type double patenting** as being unpatentable over claims 14-25 of copending Application No. **10/546,284**, optionally in view of **Ida Lee (WO)** or **Gao et al.** ("Plasma breaking of thin films into nano-sized catalyst for carbon nanotubes synthesis").

The copending application (284) claims are directed to overlapping scope claimed in different orders & employing during language, however both sets of claims are depositing material (may be Ni) on the support (may have titanium nitride barrier layer thereon), where the present application describes deposition of the material \equiv catalyst layer as "forming multiple

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separate layers of the catalytic material over a period of time", which encompasses the copending (284)'s claims of patterning the deposit via use of a mask during deposition {*analogous to the process of Merkulov et al. (951) discussed above*}. Also as both sets of application claims may employ the same catalytic material & same barrier layer material, surface tension & reactivity relationships may be considered equivalent. Also, both cases specified that the catalyst may be post-treated, with the instant case specifying "putting this thin layer into drops" via the electric process of heat treatment, while the copending case claims "annealing... to obtain a fractionation of the layer of the catalyst in the shape of drops", thus while employing different language, are presenting overlapping concepts, since annealing is a heat treatment, etc. While the copending case, when claiming carbon nanotubes growth as a catalytic drop structure, does not particularly specify that the process is via vapor deposition, it would've been obvious to one of ordinary skill in the art to employ vapor deposition in the claimed carbon nanotube growth process, as the catalytic structure claimed for the nanotube growth would reasonably have been expected to be employed in a vapor process in order to provide selectivity as claimed, especially considering common techniques for such carbon nanotube growth are generally CVD techniques.

Alternatively, if one considers applicants' taught meaning for "deposition in a discontinuous form", where the deposition is discontinuous in time rather than in space, with respect to be the claimed "discontinuous manner", the references of **Ida Lee** (discussed above), or **Gao et al.** (abstract & experimental procedure, using pulsed laser deposition of catalytic metal) provide teachings with respect to deposition of metal catalyst material intended to be fragmented into drops via post-deposition treatment processes, which are deposited via temporally discontinuous pulsed techniques; it would've been obvious to one of ordinary skill in the art, to employ such

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deposition techniques for the generic deposition of a catalytic layer of material of the copending claims, as these claims do not specify any particular means of deposition, thus one of ordinary skill would have been expected to employ techniques known to be effective in analogous art, such as Ida Lee or Gao et al. Furthermore, both of these references also when teaching their carbon nanotubes synthesis on the fragmented catalytic material, particular specify CVD growth conditions for producing the carbon nanotubes, thus supporting the above assertion with respect to the obviousness of employing CVD techniques with fragmented or particulate catalytic layers.

Note with respect to the presence of a partial pressure of oxygen during the deposition, which requires no specific partial pressure, nor any effective from the partial pressure of oxygen, that it may be considered that virtually any process as discussed above that is performed on earth, even if vacuum deposition conditions are employed, will have some partial pressure of oxygen, even if it is extremely small, as absolute vacuum is not employed, so some very small partial pressure of air would have been expected to be present & air has itself a partial pressure of oxygen.

This is a provisional obviousness-type double patenting rejection.

14. **Claims 1-2, 4, 6, 8-9, 13-14, 16-17 & 21-25** are rejected on the ground of **nonstatutory obviousness-type double patenting** as being unpatentable over claims 1-21 of U.S. Patent No. **7,544,547 B2** (Fournel et al.), in view of **Gao et al.** ("Plasma... nano-sized catalyst...").

Claim 5 is rejected on the ground of **nonstatutory obviousness-type double patenting** as being unpatentable over claims 1-21 of U.S. Patent No. **7,544,547 B2** (Fournel et al.), in view of **Gao et al.** ("Plasma... in view of **Lee et al.** (EP).

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The copending patent (547) to overlapping inventors is directed to a process having overlapping subject matter with the present claims, claimed employing varying nomenclature & varying orders, plus while having additional steps not presently required, these additional steps are also not excluded by the present set of claims, as currently amended. Particularly the copending claims only require generic deposition of a first material used for catalytic growth of nanostructured materials, where the nanostructures are organized periodically via fractionalization by heat treatment, which is considered equivalent & overlapping with the presently claimed nomenclature to create droplet shaped bodies. Also while the copending claims specify growth of nanostructures, they do not particularly specify that their nanostructures are carbon ones, however as noted above applicants' claims are still ambiguous with respect to whether or not the nanofibers must necessarily be carbon. It is also noted that while the patent claims do not use the terminology "thermal or diffusion barrier layer", they do claim the use of an intermediate layer deposited on the support surface, with listing of such materials inclusive of SiO_2 , Si_3N_4 , Al_2O_3 , diamond, etc., which materials will effectively & inherently produce thermal &/or barrier properties depending on environmental exposure, as well as rating on the newly claimed oxide barrier layer option.

With respect to be the claimed "forming multiple separate layers of the catalytic material over a period of time", **Gao et al.** (abstract & experimental procedure, using *pulsed laser deposition* of catalytic metal) provide teachings with respect to deposition of metal catalyst material intended to be fragmented into drops via post-deposition treatment processes, which are deposited via temporally discontinuous pulsed techniques, which may be considered to deposit separate sublayers of catalytic material with each pulse depending on timing, therefore it

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would've been obvious to one of ordinary skill in the art, to employ such deposition techniques for the generic deposition of a catalytic layer of material of the copending patent (547) claims, as these claims do not specify any particular means of deposition but require deposition of a continuous layer which pulsed laser deposition is capable of supplying, thus one of ordinary skill would have been expected to employ techniques known to be effective in analogous art, such as Gao et al. Furthermore, Gao et al. is also teaching the use of their catalyst for particular nanostructures synthesis of carbon nanotubes synthesis on the fragmented material, particular specify CVD growth conditions for producing the carbon nanotubes, thus providing motivation for employing their taught CVD techniques with fragmented or particulate catalytic layers to produce such carbon nanotube structures.

With respect to the use of particular catalytic metal & deposited on particular underlying (diffusion barrier layer) material, the patent a claims may deposit their catalytic layer on an intermediate of material which may be silica or alumina, hence as discussed above Lee et al. (EP), in combination with Gao et al., provides for the obviousness of this specific combination of materials one particularly depositing carbon nanotubes, thus given taught equivalents (discussed above) of titanium nitride, with titanium or silica or alumina, and the desirability of using such titanium or titanium nitride barrier layers when specifically depositing carbon nanotubes on the catalytic material, thus it would've been obvious to use these specific materials for their expected effectiveness in the process.

See above discussion concerning oxygen partial pressure (section 13), which is also relevant here.

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15. **Claims 1-2, 4, 6-9 & 13-17, 21 & 23-24** are provisionally rejected on the ground of **nonstatutory obviousness-type double patenting** as being unpatentable over claims 25-42 of copending Application No. **11/915,238**, in view of **Ida Lee (WO) or Gao et al.** ("Plasma breaking of thin films into nano-sized catalyst for carbon nanotubes synthesis").

Claim 5, 22 & 25 is provisionally rejected on the ground of **nonstatutory obviousness-type double patenting** as being unpatentable over claims 25-42 of copending Application No. **11/915,238**, in view of **Lee et al. (EP)**, & in view of **Ida Lee (WO) or Gao et al.** ("Plasma...").

The copending **application (238)** claims are directed to overlapping scope claimed in different orders & employing different language, however both sets of claims are depositing material that may be employed for catalytic CVD formation of nanostructures, where these materials are deposited on surfaces that may have diffusion barrier layers thereon & may be heat treated to cause fragmentation \equiv formation of droplet shaped bodies, as the copending application's language of increasing the temperature is synonymous therewith present process applying heat. Copending (238) provides generic claim limitations with respect to depositing means for their catalyst layer, however specifically relates to using resist structures for patterning to create a discontinuous deposit, thus is analogous to discussion of copending (284) in section 13 above, thus the teachings of **Ida Lee (WO) or Gao et al.** ("Plasma...") are applicable to copending (238) for reasons as discussed above with respect to copending (284). The copending claims of (238) are silent with respect to specific barrier layer material or specific catalytic material, however the specific materials of nickel & titanium nitride used in the claimed catalytic processes would've been obvious given the teachings of **Lee et al. (EP)** for reasons as

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analogously discussed in sections 14 or 10 above. Also note above relevant discussions with respect to carbon nanotubes versus nanostructures & partial pressure of oxygen.

16. **Claims 1-2, 6-8, 21 & 23-24** are rejected under 35 U.S.C. **102(e)** as anticipated by or, in the alternative, under 35 U.S.C. **103(a)** as obvious over **Keller et al.** (2005/0000318 A1).

It is noted that the new limitation of "forming multiple separate layers of catalytic material over a period of time" is considered consistent with Keller et al.'s option in [0071] of forming a composite film having a plurality of layers containing different concentrations of metal nanoparticles (\equiv droplet-shaped bodies) be a use of a plurality of precursor compositions having different concentrations of compounds &/or different metallic compounds and organic compounds, thus reading on multiple separate layers, which inherently would have required deposition separately, thus over a period of time to produce the taught configuration, or alternatively it would've been obvious to one of ordinary skill & competence that sequential deposition would be required, which necessarily would take place over a period of time. Note that such compositions as they contain a required catalytic metal read on applicants' catalytic material that need only "comprise" such metal. Also note that while this section does not discuss a substrate per se, the bottom layer may be considered a substrate (if the whole composite is not actually deposited on a substrate) & for the limitation of a material (unspecified) that the substrate comprises not reacting with the catalytic material, Keller et al. is teachings relate to decomposition of compounds during heating (e.g. not reacting together per se) or catalytic formation of nanotubes, noting that catalytic processes are required to leave the

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catalyst unreacted (or it's not a catalyst), thus this limitation that is significantly lacking in clarity, is considered sufficiently covered.

As previously set forth, **Keller et al.** (abstract; [0029]; [0032-33]; [0039]; [0043-46]; [0049]; [0054-56]; [0067-72, esp.71]; [0077]; & [0133]) teach a composition having a metal compound & organic compound, which when heat-treated decomposes to form metal nanoparticles, where the organic component may also decompose & react so as to form carbon nanotubes catalyzed by the presence of the previously formed metal nanoparticles. While the majority of the disclosure concerns bulk composition and synthesis, there are also teachings with respect to forming films ([0070-71]; [0077] & [0133]), with it specifically taught that films may be formed of a plurality of layers or compositions, & that precursor compositions are cast as adjacent layers before formation of the metal nanoparticles in the composition, thus for such multi-composition cast coated constructions, the deposition may be considered to have been performed in a discontinuous manner. Furthermore, as the taught cast coating for forming films is a process that inherently requires casting onto a surface, a support is present; & as no specific atmospheric environment is taught to be employed during cast coating, this may be considered to imply the presence of air, thus the coating process may be considered to be done in the presence of a partial pressure of oxygen.

Alternatively, while no support is specifically mentioned as used during casting of layers for forming films, nor is it specifically mentioned that the process is done in the presence of air, it would've been obvious to one of ordinary skill in the art to perform the casting of layers to form a film in a conventional & typical manner, thus employ a support surface to enable shaping as a film, especially considering the technique of example 31 ([0133]) that forms a thin film of

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the composition on a silica surface, heat treats to form a Co nanoparticle-carbon nanotube results, further showing the obviousness of employing a support surface for taught cast coating of multiple layer &/or composition films. It would be no further obvious to one of ordinary skill in the art, that as the cast coating process is not sensitive to the atmospheric composition, to merely perform it in air, as the most efficient & cost-effective means of performing this step. Is

17. **New art of interest includes: Samuelson et al.** (2005/0011431 A1 \equiv 7,608,147 B2 \equiv 2010/00354142 A1) that has teachings of forming nanowhiskers \equiv nanofibers (*but metal nano whiskers, not carbon that ambiguously read on applicants' nanofibers*) using arrays of masses of catalysts (e.g. gold) that are heated to form catalytic seed particles (i.e. droplets), with teachings concerning the **importance of wetting** at the interface, such that there is neither insufficient or too much wetting occurring between the substrate surface & the catalytic material during heating (abstracts & [0083-86] in (412) & [0082-85] in (431)), noting that the exemplary patterning techniques given may be masked deposition equivalent to that as discussed above with respect to Merkulov et al. (951), thus the Samuelson references are presently redundant to above rejections, but considered significant to applicants' possible intent with respect to their unclearly claimed surface tension limitations, since surface tension & wettability are discussing analogous properties & effects. Also, **Burke et al.** (7645482 B2 & 7718224 B2) & **Li et al.** (2009/0283735 A1), are not prior art, but have teachings of interest with respect to discontinuous deposition of films for creating nanoparticle catalyst for subsequent nano carbon depositions.

Other art of interest previously cited included: **Dominguez et al.**, ((575): abstract; figures; [0007-8]; [0011]; [0013-18, esp. 13 & 17-18]; [0020] & claims, esp. 1, 3-5 & 8-10), which teach deposition of a film containing active components that may be catalytic metals, such

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as nickel; & inactive components that may be Ti, Al, dielectric materials, e.g. oxides like titania, which is equivalent to **Dominguez et al.** (7,635,503 B2) issued from the same application; **Choi et al.** ("Density control of carbon nanotubes using NH₃ plasma treatment of Ni catalyst layer"), cited in the IDS, is of interest to the nonelected species of hydrogen-containing plasma pretreatment of a deposited material (Ni catalytic layer on Cr buffer layer), which issues that for catalytic growth of carbon nanotubes, & is equivalent to above applied references for the generic claims that do not specify require post-discontinuous deposition heat treatment, except it does not specify that the nickel is initially discontinuously deposited, either spatially or temporally; **Gao et al.** ("Plasma breaking of thin films into nano-size catalyst for carbon nanotubes synthesis"), also citing the IDS, is similar to Choi et al., except deposits Fe thin films via pulsed laser deposition, then employs a N-plasma to break the thin film into uniform nano-size catalyst particles; **Ota** ("specific conditions for Ni catalyze carbon nanotubes growth by chemical vapor deposition") while teaching the post metal deposition heat treatment to control nickel particle sizes, deposits via CVD without teachings of any discontinuous manners; **Cotell et al.** ("Microstructural development of thin films grown by pulsed laser deposition"), cited in the IDS, shows that use of pulsed laser deposition versus other vapor deposition processes (i.e. a temporally discontinuous deposition process versus continuous) does not have any significant effect on the produced microstructure for a range of taught substrates & substrate temperatures, which indicates that applicants lack of operational/parameter details with respect to their temporally discontinuous deposition is a significant flaw in the disclosure.

Further art of interests includes: **Dai et al.** (WO 00/30141), who also teach patterned catalytic layers for vapor depositing carbon nanotubes, where the catalytic material may be a

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patterned film made using e-beam evaporation of iron through a shadowmask, with subsequent annealing in air to create patterned iron oxide catalyst; **Legagneux et al.** (WO 03/048040 A1), whose English abstract indicates relevant teachings concerning catalytic layers on a diffusion alloy barrier film, for use in catalytic growth of nanotubes/nanofibers; **Shin et al.** (2002/0014667 A1), who teach control of shape & size of catalyst pattern in order to control growth of carbon nanotubes, including discontinuous deposition the use of a mask, which may be removed after catalyst deposition by heating, however they are interested in depositing carbon nanotubes in a horizontal direction, thus deposited film does not provide any "drop" shapes after heating; **Kishi et al.** (2003/0098640 A1) provides teaching concerning metal thin film formation via vacuum evaporation or CVD, with subsequent heating to agglomerate catalytic sites, forming discontinuous film surface, where subsequent heating in oxygen atmosphere will catalyze reactions to process carbon nanotubes via oxidation (as opposed to form them); while **Hirasawa et al.** (2002/0171347 A1), **Simpson et al.** (2002/0024279 A1), **Geohegan et al.** (2006/0279191 A1), **Huotari et al.** (2009/0246367 A1 & 7491634 B2) & **Cheng et al.** (2002/0163287 A1), all provide further teachings concerning the use of catalytic metal layers used in the formation of carbon nanotubes.

Also noted of interest, are copending cases **12/412,497**, **12/004,883** & **11/174,537** to at least overlapping inventors that have claims directed to be relevant processes for catalytic formation of nanotubes or nanostructures, but presently do not necessitate an obviousness double patenting rejection.

18. Applicant's arguments filed 3/22/2010 & discussed above have been fully considered but they are not persuasive.

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19. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

20. **Any inquiry** concerning this communication or earlier communications from the examiner should be directed to **Marianne L. Padgett** whose telephone number is **(571) 272-1425**. The examiner can normally be reached on M-F from about 9:00 a.m. to 5:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached at (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR

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system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free)?

/Marianne L. Padgett/
Primary Examiner, Art Unit 1792

MLP/dictation software

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